SCIENCE.—SUPPLEMENT.

FRIDAY, DECEMBER 11, 1885.

PHYSIOLOGY OF THE BRAIN.

THE recently published memoir of Dr. J. Steiner[1] is an especially important contribution to this very difficult field of research, and one which is likely to have influence not only from its intrinsic merit as an investigation, but also from the unusual literary excellence characterizing the author's presentation of his subject. The frog was chosen for the experiments on account of the comparative simplicity of its brain. The experiments consisted in a series of systematic removals of portions of the brain; and to the thoroughness and patience with which this system of study was executed the success must be attributed. Steiner removed first the hemispheres, and records in his memoir the observed results; next both the hemispheres and optic thalami; then the mid-brain; then the cerebellum; finally the upper part of the medulla. Then follow experiments with asymmetrical removals. Together with the description of each operation is given the account of the physiological phenomena which ensue from it. The discussion of the interpretation of the observations is kept separate, — an essential advantage to the reader.

The most important conclusion reached is, that in the anterior portion of the medulla oblongata there is a common centre for the co-ordinated movements of the head, rump, and limbs; or, in other words, that we cannot separate the three centres topographically, and can establish the fact of their organic connection. This central office Steiner names the brain-centre (*hirncentrum*). By ingenious experiments and reasoning he renders it probable that the upper parts of the brain (*bigemina*, etc.) contain no general co-ordinating motor-centres, but only sensory centres and pathways; that is to say, they act to the brain-centre the *rôle* of centrifugal nerves, and the brain-centre is the only locomotion centre of the body.

The relation of the brain-centre to the reflex centres of the spinal cord is very remarkable, and is demonstrated by the reactions of a frog deprived of its hemispheres to irritations produced by varying strengths of sulphuric acid placed on the skin. The strength is gradually increased until a reaction occurs. The first reaction is a locomotion; a little stronger, and there is first a locomotion, and then the well-known reflex wiping motion to remove the irritant; the wiping motion causes the stoppage of the locomotion — the interpretation of this fact is that the brain (locomotion) centre is more readily excited than the reflex centre in the cord, and that the reflex centre inhibits the action of the brain-centre. This is another of the increasing number of instances of the reaction consequent upon stimulation of a given part varying with the strength of the stimulus. This discovery already appears to us of very far-reaching significance for the future of nervous physiology.

In a second chapter the author establishes asymmetrical injury of the brain as the cause of compulsory curvilinear motions (*mouvements de manège, rollbewegungen*, clock finger movements, etc.). For further details we must refer to the interesting original.

Dr. Josef Paneth brings a new contribution[1] to the solution of the vexed question whether the cortex cerebri of new-born animals is irritable. He attributes Toltmann's negative results, which are accepted in most text-books, to the use of narcotics by that experimenter, and reports thirteen experiments made by himself on dogs, of which eight gave a positive, four a probably positive, and one a negative result. It may be added that animals which are born more advanced in development (as, for instance, guinea-pigs) have been already shown to have an irritable cortex at birth. The only irritable area was half a square centimetre in the region of the sulcus cruciatus. Microscopical examination showed the absence of medullated fibres in this region, so that Toltmann's view that their presence is essential to irritability is not sustained. Paneth's results agree with those previously reached by Lemoine.[2]

C. S. MINOT.

[1] *Untersuchungen über die physiologie des froschhirns.* Von Dr. J. STEINER. Braunschweig. *Vieweg*, 1885. 8°.

[1] *Ueber die erregbarkeit der hirnrinde neugeborener hunde.* Von J. PANETH. *Pflüg. archiv f. physiol.*, XXXVII. 202.

[2] Lemoine, *Contribution à la détermination et à l'étude expérimentale des localisations fonctionelles encéphaliques.* Paris, 1880.

GEOLOGICAL SURVEY OF CANADA.

THE Dominion of Canada embraces nearly half the continent; but the greater part of this vast area is still a trackless wilderness; and the labors of the geological survey, in its earlier decades, were wisely concentrated upon those districts in the eastern provinces and the valley of the St. Law-

rence which are and must always remain the chief seats of population and wealth, and an accurate knowledge of which must therefore always be of prime importance. This result is now in a large measure accomplished; and meanwhile the external conditions have greatly changed. The Canadian Pacific railway has connected the Gulf of St. Lawrence with the Gulf of Georgia, and flourishing communities have arisen in British Columbia and Manitoba. With this tide of immigration and development in the far west has come not only the possibility, but the necessity, of greatly extending the field and changing the plan of the survey. The outlines of the geology of a vast region are being rapidly traced, while the elaboration of details is mainly left to the future, save where there is promise of important economic developments.

The 'Report of progress of the Canadian geological survey for 1882–84,'[1] includes, besides the summary report of the director and two contributions from the chemist of the survey on the composition of the coals and lignites of the north-west territory, and various building stones and ores, thirteen separate reports on explorations, in nearly as many different sections of the dominion. These are arranged in geographical order, beginning in the far west; and it is therefore especially surprising to find that the first report was written twenty-five years ago, though now published for the first time. This is an account of the geology of the country near the 49th parallel, west of the Rocky Mountains, by Mr. H. Bauerman, geologist to the boundary commission. The publication of these rather antiquated observations seems to be justified by the fact that they largely relate to districts which have not been covered by more recent explorations.

This is followed by the most important of recent contributions to Canadian geology; Dr. G. M. Dawson's final report of 170 pages, on the region of the Bow and Belly rivers, embracing an area of about 27,000 square miles of prairie and plateau country lying in the angle between the United States boundary and the eastern base of the Rocky Mountains. This district, which touches the paleozoic rocks of the mountains, and is based on the cretaceous and Laramie formations, is the first in the north-west territory of which a systematic and proximately complete examination has been made, and is of special importance in consequence of the proximity of the valuable coal and lignite deposits to the line of the Canadian Pacific railway. These are shown to be wide-spread and practically inexhaustible; and the main geological features are so clear and easily read, that, although the details are largely left to the future, the present report and map will be found adequate for a long time. The treeless character of the plains is in a large measure offset by the fossil fuels, but their aridity is not thus mitigated. That the climate has become drier in post-glacial times, is very plainly indicated by the broad, deep drainage channels known as *coulées*, which were evidently formed by large rivers, but are now dry, or nearly so.

Dr. Robert Bell's report on the Athabasca River gives the results of a rapid geological reconnaissance of the valley of that stream from the 55th parallel to Lake Athabasca. We have here the first definite information concerning a geological section, which, like that on the Bow and Belly rivers, is chiefly remarkable for its simplicity and its promise of important economic developments. It consists of cretaceous marls and sandstones resting horizontally but unconformably on horizontal beds of Devonian limestone; and the lower part of the cretaceous is, over an area of thousands of square miles, supersaturated with asphaltum and petroleum. In no other extensive petroleum-field, probably, are the conditions so simple and so clearly exposed as here. It is very much as if the two thousand feet of barren rock covering the oil-sands of Pennsylvania were removed. In the Athabasca field, too, the much-vexed question of the origin of petroleum seems to find a ready solution, the facts affording substantial support to the theory that the oil has its source in the underlying limestone, which is distinctly oleiferous.

Dr. Bell also accompanied the expedition sent out in 1884 to establish meteorological stations at various points in Hudson's Strait and Bay. But he enjoyed no special facilities, and the desultory observations here published are all that could have been reasonably expected, even from so experienced an observer, especially considering that he was not only the geologist, but the zoölogist, botanist, taxidermist, photographer, and medical officer of the expedition. The glacial phenomena, past and present, received most attention; and the interesting fact is established that the top of the coast-range of Labrador projected above the ice-sheet, and was not glaciated. This report is accompanied by lists of the plants, mammals, birds, crustacea, marine invertebrates, and lepidoptera collected.

Professor Laflamme's observations on the Saguenay have so greatly extended and multiplied the known areas of Trenton limestone as to suggest that this rock may once have covered the Laurentian highlands continuously from the St. Lawrence to Hudson's Bay, this part of the continental nu-

[1] *Geological survey of Canada. Report of progress for 1882–84.* Alfred R. C. Selwyn, director. Montreal, *Dawson*, 1885. 8°.

cleus having been completely submerged by the sea of that period. But it must have been dry land previously, since no traces of the Chazy, calciferous, and Potsdam are found beneath the Trenton, which rests directly and horizontally upon the Laurentian gneiss, and is so related to the present elevations and depressions of the gneissic surface as to indicate that they are in large part the result of erosion in pre-Cambrian times.

The reports by Messrs. Ells and Low on the Gaspé Peninsula, with the maps, indicate considerable progress in the elucidation of this small but very formidable wilderness; and Mr. Ells's notes on the geology of Prince Edward's Island prove that the so-called triassic beds of this island belong almost wholly to the Permo-carboniferous.

Prof. L. W. Bailey continues his investigation of the geology of New Brunswick in a report on Carleton and York counties, which is devoted chiefly to the Silurian and supposed Cambro-Silurian strata. The latter consist mainly of highly crystalline gneisses and schists; and the only evidence of their Cambro-Silurian age consists in the fact that they are overlain unconformably by the Silurian beds, coming between the latter and the great granite axis, by which it is supposed they have been metamorphosed.

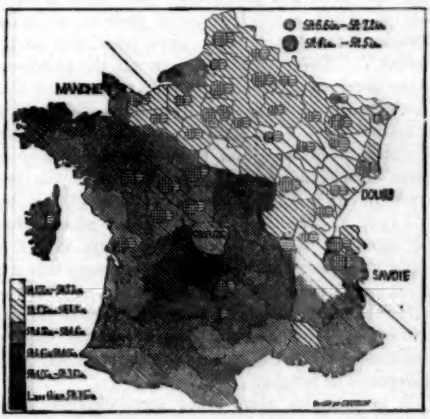
Mr. R. Chalmers describes at considerable length the interesting glacial phenomena of the same region.

Mr. Hugh Fletcher's extended report on the northern and hitherto unsurveyed portion of Cape Breton, with the accompanying map of the whole island, places the geology of this province on a par with that of the rest of Acadia. The scale of the map, which covers 24 sheets, is entirely too liberal, being at least twice as large as either the topographic or geologic details require; and the bulkiness of the map seriously diminishes its usefulness, especially in the absence of a general map of the island on one sheet.

The remainder of the volume is made up of detailed reports on the apatite mines and deposits of Ottawa county, and the gold mines of the Lake of the Woods, and some scattering observations on the mines and minerals of Ontario, Quebec, and Nova Scotia.

HEIGHT IN FRANCE.[1]

IN the accompanying map of France the average height of the inhabitants is indicated by the shading, in which the darker shades denote the smaller, and the lighter shades the greater heights. It will be seen that a line, as shown on the map, running diagonally from Manche in the north-west to Savoie (Lyons) in the south-east, divides the country into two parts. To the north-east of this line the inhabitants are above the average height; to the south-west of it, below the average. This phenomenon was known to Broca, who ascribed it to racial influences alone. He held that the Celts and the Cymri mentioned by Cæsar were the racial ancestors of the present French people. The Celts were of mean height, and were further distinguished by their round heads and bulging foreheads, and light hair and eyes; while the Cymri (or Belges of Caesar) were tall, and had long heads, with broad, high foreheads and light hair and eyes. Broca had also pointed out that unusual deviations from the average height were more common in those regions which we may regard as the country of the Celts, and rare among



the Cymric people. Broca prepared his map according to the frequency of the deviations from the average height, and his result is quite similar to what is obtained when, as in the present instance, the average height itself is the basis of comparison. In both cases France is divided by a line from north-west to south-east into two parts, the inhabitants of one of which are markedly taller than those of the other, while about the same regions appear as the extremes either of tallness or smallness in both cases.

It is well known that if the height of a large number of men are taken, and the number of men at each height be recorded, the largest number of records will centre about the mean height of the whole group, and the number will grow smaller as we leave the point of average height to either side. It is further known that the frequency of the records at each point of the scale is determined by

[1] From the *Revue scientifique*, October, 1885. By M. JACQUES BERTILLON.

the probability curve. The applicability of this curve to the representation of height has been frequently tested, and is found always to hold wherever the conditions upon which the law depends are present; viz., that variations in the phenomenon in question be due to a large number of causes, no one of which has any great effect. Where the law does not hold in the case of a series of heights, the probability is strong that there are some influences in question which cause a considerable variation in the average height. In several parts of France there is a strong indication of the existence of two types, distinguishable by their difference in height. If we draw the curve of height for these portions, this phenomenon is evident. A good example is shown in the department Doubs. The top of the curve for this region is M-shaped, while, in dealing with a case in which the probability case does hold, — that is, when a single type is present, as in La Creuze, — the top of the curve resembles an inverted V. There exist, then, in all the provinces in the north-eastern half of France, two types which can actually be separated from each other. This is shown on the map by the occurrence of pairs of smaller circles; and the ratio of the size of these circles indicates the proportion of the two types in each part. The average height of the tall type is 5 feet 6.6 inches; of the other, 5 feet 4.6 inches. It is certainly a curious fact that these two peoples, who now have every thing in common, — language, mode of life, and all, — who intermarry freely, and probably have no consciousness of their dual origin, should still be unidentified by the constant characteristic of a difference in height.

It is probable that other circumstances than those of race can affect the stature of a people. Chief among these are, 1°, the well-being of the community; and, 2°, pathological conditions. There are countries where the average stature has changed without the introduction of a new racial element. In the low countries (Holland, etc.) this phenomenon is ascribed to the effect of the draining of the marshes, and the general betterment of the people.

The statistics of Saxony, from 1852 to 1854, make possible a comparison between the heights of the liberal and the laboring professions. If we draw the curves representing the number of each class at each height, the curve for the liberal professions shows a superiority of height throughout. They have fewer short persons, and more tall ones. The difference between the two, however (5 feet 5.6 inches and 5 feet 4.25 inches), is smaller than in the case of racial difference.

A case in which pathological influences (such as cretinism) seem to be active is offered in Switzerland. Here there seems to exist a true type of dwarfs whose heights centre about 4 feet. The suggestion that minor influences such as these may also be active in producing the differentiation of height in France, is worthy of consideration.

THE EXTRACTION OF SUGAR FROM SORGHUM AND SUGAR-CANE.

The experiments in the application of diffusion and carbonatation to the extraction and crystallization of sugar from sorghum, which have been in progress under the direction of Dr. H. W. Wiley and his assistants at Ottawa, Kansas, during September and October, have been described by him in Bulletin No. 6 of the chemical division of the department of agriculture. The difficulties met with were largely of a mechanical nature, or resulting from the effects of early frost injuring the quality of the cane which was used for the experiment.

Of the trial on Oct. 8, Dr. Wiley says that during a run of about 21 hours, 70 cells, of about 1400 pounds of cane apiece, or 49 tons, were diffused, giving from 65 cells 96,140 pounds of juice. The exhausted chips contained less than 2 per cent of sugars, and the waste waters about the same amount; so that the extraction may be said to be nearly complete. The cost was about 80 cents per ton, and, with improvements in the mechanical details of the apparatus, labor and fuel can be saved, and the cost reduced to 30 cents. The juice drawn off stood to the cane chips in the ratio of 110 : 100 in the first, and 95.3 : 100 in the second, part of the experiments. The solids it contained varied from an average of 1.024 per cent, corresponding to a specific gravity of 1.0394 at 25° C., in the first half, to 10.55, corresponding to 1.0405 at 25° C., in the second half, of the experiment.

The juice corresponding to 15 tons of cane was defecated by the method of carbonatation, and yielded 4820 pounds of *masse cuite*, containing 77 per cent of solids, or a little more than 14 per cent of the cane worked. This, on being 'swung out,' yielded 1420 pounds, or 30 per cent of sugar well washed and dried, polarizing about 98 per cent, or at the rate of 95 pounds to the ton. The yield of second sugars would, of course, increase the rate of production per ton. Allowing 12 pounds to the gallon for the *masse cuite*, the number of gallons per ton would be 24, which is far in excess of the amount usually produced.

Dr. Wiley's general conclusions are as follows: —

1. By the process of diffusion 98 per cent of the sugar in the cane was extracted, and the yield was

fully double that obtained in the ordinary way. 2. The difficulties to be overcome in the application of diffusion are wholly mechanical. 3. The process of carbonatation for the purification of the juice is the only method which will give a limpid juice with a minimum of waste, and maximum of purity. 4. By a proper combination of diffusion and carbonatation, the experiments have demonstrated that fully 95 per cent of the sugars in the cane can be placed on the market either as dry sugar or molasses.

PROGRESS IN METALLURGY.

ONE of the serious metallurgical problems of today is the recovery of the by-products from the manufacture of coke by the destructive distillation of bituminous coal. In this country coke for metallurgical purposes is prepared almost exclusively either in open heaps or in 'beehive' ovens, — hemispherical fire-brick chambers into which sufficient air is admitted to burn the distillates, and thus to produce the heat required for the distillation itself. Not only are the distillates, which contain ammonia and tar, of great value to the color-maker, thus wasted, but, as they burn in actual contact with the coking mass, much (often twenty-five per cent) of the coke itself is incidentally burned. Both these evils are completely avoided by coking in retort ovens, heated externally by the combustion of the distillates, but after they have deposited their tar and ammonia in surface condensers. The first volume of the Journal of the Iron and steel institute, for 1885, contains an important group of papers and discussions on this subject, whose net result is to place the advocates of retort coking in a much stronger position.

The iron blast-furnace is the chief consumer of coke; and though in continental European blast-furnaces (and in British foundery cupolas as well) retort coke is as efficient as beehive coke, and though the calorific powers of the two fuels are almost identical, yet in British and American blast-furnaces the efficiency of retort coke has hitherto proved so low as to largely offset the advantages of the retort, — its greater yield of coke and its recovery of by-products. Hence the retort has gained but a slight foothold in these countries, though used on the continent very extensively and successfully with coals of widely varying compositions and properties. We may solve the retort problem either by adapting our retorts to the requirements of our coal, or by adapting our blast-furnaces to the requirements of retort coke.

Mr. J. Lowthian Bell shows by conclusive experiments that the low efficiency of British retort coke is due to its ready solubility in the carbonic acid which it encounters on entering the blast-furnace; and this, in turn, appears to be mainly due to the comparatively low temperature of retort coking. It would seem practicable, however, to raise this temperature approximately to that of the beehive; and Mr. H. Simon and Mr. Watson Smith describe the adaptation of the Siemens regenerative system to the retort for this purpose, and the improvement in the quality of the tar which it has effected. The problem of adapting the retort to the coal seems thus in a fair way to solution, while that of adapting the blast-furnace to retort coke appears to be in an equally promising condition, if we may judge from comparative tests which Samuelson describes, conducted on a gigantic scale in his blast-furnaces, themselves highly efficient, in which British retort coke shows an efficiency equal to that of the best beehive coke. This one success outweighs in importance fifty previous failures.

A very important contribution to the world's supply of tar and ammonia is promised from another source. A large and constantly increasing proportion of our metallurgical furnaces are heated by gas produced by the simultaneous distillation and partial combustion of bituminous coal and similar substances. In the apparatus employed the hydrocarbons, etc., arising from distillation, incidentally become diluted with such enormous volumes of nitrogen and carbonic oxide from the partial combustion of the coal, that the condensation of their tar and ammonia would require apparatus of a size and cost which are simply prohibitory; and, unable to separate these valuable substances, we burn them in enormous quantities. But Mr. John Head describes an egg of Columbus which promises to enable us to isolate the distillates for condensation and the manufacture of illuminating-gas.

A knowledge of the relations between the chemical composition and the physical properties of iron, which would enable us to infer the latter from the former, would be invaluable: unfortunately investigation has thus far only plunged these relations into hopeless confusion. To elucidate the subject, Dr. Hermann Wedding has carried out extensive and ingenious microscopic studies of the structure of iron. We have not space to analyze the results which he here presents, further than to give as a sample his announcement that malleable iron, produced by any fusion process, consists of two distinct components: 1°, minute porphyritically distributed crystalline particles; and, 2°, a homogeneous matrix in which they are distributed.

RECENT CHALLENGER MONOGRAPHS.

Four great books of final reports of the Challenger expedition, together with two volumes of 'the narrative,' represent the outcome of the last few months of work of the Challenger staff. Commendation seems superfluous in describing a work so monumental in its character; but, on the other hand, it is impracticable to speak of it, either as a whole or in any one of its subdivisions, without the most enthusiastic praise.

Professor Turner of Edinburgh discusses the human crania in a paper of 130 pages (part xxix. vol. x.), which is one of the most important contributions to somatology ever printed in English. The last sixteen pages are devoted to general conclusions, drawn, not only from the study of the crania gathered by the Challenger in southern Africa and America, Australia and the Pacific Islands, but of those in the Edinburgh university museum and several other collections. The paper is, in fact, an essay upon the craniology of certain races, — the Bushmen, Fuegians and Patagonians, Australians, New Zealanders, and the Admiralty, Chatham, and Sandwich Islanders. A short paper, on the other human bones is to follow. The body of the memoir is densely packed with details of craniometry, for the most part in tabular form, and critical notices of past investigations. The 29 illustrations are exceedingly satisfactory, especially the diagrams of sections of skulls drawn by the author.

One of the most noteworthy results of this investigation is that it has given Professor Turner still stronger convictions upon the importance of craniology as the foundation of a classification of the races of mankind. Without undervaluing the classific value of such features as the color of the skin, the color and character of the hair and eyes, the shape of the nose and lips, the stature and the form of the pelvis, he maintains, that, by taking a combination of craniological characters, there may be laid down certain propositions as regards *unmixed* races of men, which, while allowing for the occurrence of occasional individual variations, will be as distinctive as those afforded by the study of any other series of physical characters.

In unmixed races, where the skull is markedly dolichocephalic, brachycephalic skulls never occur; and similarly in unmixed races, where the skull is markedly brachycephalic, dolichocephalic skulls are not met with. People resulting from mixtures, especially of dolicho- with brachy-cephalic races, are more difficult to deal with; for some will have heads which exhibit, with little variation, the characters of one or other of the two parent types, while in others intermediate characters will arise which incline toward those of one or other of the ancestral types. It is, he thinks, through lack of recognition of the true effects of mixture of races that discredit has been thrown on the value of the skull in the determination of racial characters.

The author, while inclining to the belief that, as a rule, unmixed races are either long or short headed, and that mesaticephalic peoples usually proceed from mixtures, admits that certain of the mesaticephali — for instance, the Tasmanians, and the Bush race of South Africa (not improbably the remains of the primitive people of Africa) — may be classed with the unmixed races.

The discussions of the extent and character of individual variation within the limits of a race are to be of a very scholarly and suggestive character.

The author advances the idea that the races of the extreme south, Bushmen, Fuegians, Australians, Tasmanians, and Negritos, with their feeble frames, small heads, low statures, and low intellectual development, may in the early unwritten periods of history have had in their respective continents a much wider range than at present, and have been pushed southward into their present restricted areas by the advance of the more powerful races which now surround them. If in their displacement they failed to mix with their invaders, their physical characters would remain pure, for isolation and long-continued interbreeding would preserve and even intensify the structural peculiarities of each race.

The enigma concerning the builders of the megalithic monuments on Ascension and Easter Islands, the Fijis, the Gilbert Islands, and Tongatabu, is simply restated, — the natives can neither account for them by tradition, or show physical evidence that their forefathers could have created such structures, nor are there any traces of races, pre-existing in the Pacific region, capable of such enterprises.

The study of the Patagonian and Fuegian skulls suggests interesting speculations as to the origin of the peoples of South America.

It is rather mortifying to find that our own countrymen have accomplished so little in the field of craniology, that in this exhaustive treatise there occurs but a single incidental allusion to any American authority.

Dr. Rudolph Bergh of Copenhagen, in an essay of 151 pages, with 311 figures of structural details beautifully drawn by himself (part xxvi. vol. x.), treats of the Nudibranchiata. The paper is purely descriptive and critical, and deals chiefly with the 25 forms collected by the expedition, which include 11 new species and 3 new genera. He gives, however, a list of all known forms in each genus

which comes up for discussion, the number sometimes being very large, as in Chromodoris with its 95 species. The remarkable new genus Bathydoris, dredged in mid-Pacific at depths of 14,550 feet, is described at great length, and elaborately figured.

The family Onchidiadae — 'modified shell-less pulmonates,' resembling in form certain nudibranchiates — are treated of in an appendix, with historical and critical notes. Bergh believes that the tropical seas, though hitherto but slightly explored for nudibranchiates, will ultimately prove to be the headquarters of this group. The absence of allusions to American work emphasizes the fact, already pretty well appreciated on this side of the Atlantic, that in the study of this group there is an excellent opportunity for some one of our young naturalists who has not yet chosen a specialty.

The venerable George Busk prints part i. of his report upon the Polyzoa (part xxx. vol. x.), which treats of the Cheilostomata, enumerating 286 species from the Challenger's work, of which 180 are described as new. The workmanship of the paper is in the author's own peculiar style of excellence. There are nearly a thousand figures, and the pages devoted to an explanation of terms used in description are especially acceptable. The general conclusions arrived at by Mr. Busk are evidently withheld for the second part of his report. The geographical and bathymetrical distributions of the group are treated at great length, and illustrated by an instructive map. Four species of Polyzoa were taken by the Challenger in the North Pacific at the depth of 3,125 fathoms; and one of these, Cribrilina monoceras, was taken in the Australian region at a depth of 35 fathoms, — an instance of extensive range in depth unparalleled elsewhere.

Dr. Hoek's report upon the Cirripedia (part xxv. vol. viii.; part xxviii. vol. ix.), although the author mourns that his studies upon the deep-sea material have not yielded results equal to his own anticipations, is a very important contribution to zoölogy. It is printed in two parts, and is brimful of concisely stated observations and pregnant criticisms. It is an excellent example of the scholarly work which the naturalists of the Netherlands have of late been producing, and is no unworthy continuation of the classic memoir upon the same subject published a third of a century ago by Darwin. The systematic portion of the reports is devoted entirely to the description of the Challenger's collection, but in the introduction is given a critical review of all that has been discovered or written concerning the group since the time of Darwin, and also a new zoögeographical arrangement of all known species.

One of the most surprising of the recent reports is that by Dr. von Graff upon the Myzostomida of the expedition. Fifty-two of the 68 species discussed appear here for the first time. In fact, all the known species of the group have been brought to light by Dr. von Graff, with the exception of three described by Leuckart, by whom the genus Myzostoma was first discovered. These very remarkable animals, by Dr. von Graff placed among the arachnids, by other authorities among the worms, near Tomopteris, and only found parasitic upon and in crinoids, are being found in all the zoölogical collections, now that attention has at last been directed to their very inconspicuous existence. Twenty-two species, 14 of them new, are attributed to the explorations of the U.S. steamers Bibb, Hassler, Blake, and Corwin. A concise account of what is known concerning the Myzostomida serves as a preface, and there is a curious colored diagrammatic figure printed in with the text. The lithographic plates are exquisite.

In a second paper upon the Entomostraca (part xxiii. vol. viii.), Dr. G. Stewardson Brady treats of the Copepoda. His paper is mainly descriptive, and is, of course, prepared in his usual scholarly manner. There are 55 plates, diagrammatic and useful, but not artistic; and 142 pages of text, treating of 90 free-swimming species, and 15 fish parasites obtained by the Challenger, only one of which, Pontostratiotes abyssicola, dredged in a depth of 2,200 fathoms, is undoubtedly a deep-sea species.

The report upon the calcareous sponges, by Professor Poléjaeff of Odessa, a pupil of Schulze's, enumerates 30 species, 23 of which are new. A considerable portion of the paper is devoted to destructive criticism of the previous work of Professor Haeckel, and the construction of a new 'natural classification' of the group. There are four superb plates of white sponges upon black backgrounds, as well as a number of anatomical figures beautifully drawn by the author.

Mr. Henry B. Brady's ponderous memoir on the Foraminifera, in two volumes, — one of text, 814 pages; and one of illustrations, 115 plates and at least 2,000 figures, — is really a monographic revision of the entire group, with an exhaustive bibliography, from the year 1565 to the present time, and a chapter on classification, historical, critical, and constructive, leading up to an elaborate synopsis of families and genera. The synonomies and the tables of geographical distribution are made up in a very workmanlike manner, and the index is a delight to weary eyes.

The animals of this group are distributed everywhere over the ocean-bottom, as well as at the surface and in mid-waters. The presence or ab-

sence of the calcareous shells of some of the pelagic species at different depths and in different localities is connected with some of the most important problems in oceanography. It was of the greatest importance that all questions relating to geographical and bathymetrical distributions should be discussed with reference to a thorough understanding of the relations of all existing forms; and it was, indeed, a fortunate thing that a naturalist so familiar with the Foraminifera as Mr. Brady should have undertaken this work.

Mr. Brady, referring to certain views held by Dr. Wm. B. Carpenter and his colleagues concerning the existence or non-existence of true species amongst the lower Protozoa, which are, he admits, "from a purely biological stand-point, for the most part incontestable," holds that they really embody only one aspect of the subject. Although in some families, not merely reputed species, but reputed genera, are connected by a close array of intermediate modifications and dimorphous forms, and all sharp demarcations have ceased to exist, in others the successive modifications appear to be less closely connected, and to possess distinctive characters of greater persistence. "Admitting," he writes, "the intimate relationship which often prevails throughout an entire generic group, admitting even that all the members of a genus may be referred to a common ancestral type, the question still remains how the different terms of each series are to be recognized. The various modifications which have been referred to differ not merely in details of form and structure, but in habit. They are met with under diverse conditions as to latitude, depth of water, nature of sea-bottom, and the like, and their modes of life are often totally distinct; furthermore, fossil specimens, with similar peculiarities, appear to have existed under precisely corresponding circumstances. Whether 'species' or not, the more important of them possess characters which afford means of easy identification, and it is obviously necessary that they should be provided with distinctive names." He admits the value, as a method of study of the plan proposed by Parker and Jones, in their memoirs on North Atlantic Foraminifera, of grouping the almost endless varieties of the Foraminifera around a small number of typical and sub-typical species, but denies that this plan may be made a basis of nomenclature. The binomial system must be retained, and it is impossible to deal with the multiferous varieties in this group without a much freer use of distinctive names than is permissible among animals endowed with more stable characters.

The chapter on the chemical composition of the tests of the Foraminifera possesses considerable interest in connection with the study of bottom deposits. That upon pelagic species would be much more satisfactory to the reader if rather more definite conclusions could have been attained by the author of the memoir in a manner satisfactory to himself.

Eozoon is admitted to a place in the synopsis, but Mr. Brady does not commit himself to any opinions. In the introduction to his bibliography, he states that many of the titles of the less important contributions to the Eozoon controversy are admitted. The American names in the bibliography are those of Isaac Lea, the earliest, 1833, S.G. Morton, J. W. Bailey, E. de Verneuil, J. Hall, Meek and Hayden, G. G. Shumard, W. M. Gabb, J. W. Dawson, Count Pourtales, J. P. Whiteaves, C. A. White, H. A. Johnson and B. W. Thomas, T. A. Conrad, Angelo Heilprin, and J. Leidy.

The publication of the results of the Challenger is evidently being forwarded as rapidly as the limitations of painstaking research will permit. It is much to be regretted that the French zoölogists who have the work of the Talisman and Travailleur in charge do not profit more by this example.

G. Brown Goode.

U.S. national museum.

DROUGHT AND WEATHERCOCKS.

A writer in *Symons's meteorological journal* calls attention to a connection between drought and weathercocks. The connection does not always exist. Some weathercocks are entirely independent of drought or floods, and some are very seriously affected. The former are those which do not carry any of the usual letters N, E, S, W, or which are wholly of metal, and carried on metal or stone supports. The weathercocks which suffer from drought are those which have the cardinal points indicated by the letters, and which (though themselves of metal) are carried at the summit of a tall pole. The pole, under the influence of sun and drought, splits, and the cracks run nearly along its length, but not precisely. They are slightly inclined, and all run parallel. If the drought is prolonged, they become numerous, and, though no one crack may be a tenth of an inch, the aggregate amount becomes large. We have ourselves measured one on which the letters were, during the July drought, carried round 44°; the S letter was carried around until it pointed almost exactly S.W. With subsequent moisture the cracks have partly closed, and possibly by November the letter S will be nearly back in its true position; but as to this we have no knowledge. It is evidently necessary for observers to watch for the occurrence of this somewhat strange error.